Candidate Name	Class	Register Number

CHANGKAT CHANGI SECONDARY SCHOOL

Mid Year Examination 2011

Subject	:	Physics
Paper No	:	5058 / 02
Level	:	Secondary 3 Express
Date	:	11 May 2011
Duration	:	1 hour 45 minutes
Setter	:	Mr Kenny Low

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, class and register number in the spaces at the top of this page.

Answer **all** questions in Section A.
Answer **3** questions in Section B. Question 12 has a choice of parts to answer.

Candidates are reminded that all quantitative answers should include appropriate units.
Candidates are advised to show all their workings in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

The number of marks is given in brackets [ ] at the end of each questions or part question.

For Examiners' Use	**Marks**
Section A	/ 50
Section B	/ 30
Total	/ 80
Expected Grade	Actual Grade
Parent's / Guardian's signature	

This Question Paper consist of **16** printed pages including the cover page

Section A [50 MARKS]

Answer ALL the questions in the spaces provided.

1 Fig. 1 shows the positions of a simple pendulum at **A, B** and **C**.

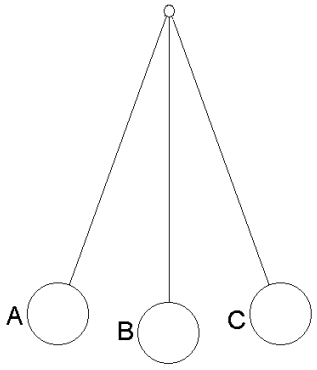

Fig 1

(a) Kerwin takes 5 sets of timing for 20 oscillations of the pendulum, and records the following times:

36.49s, 37.01s, 36.91s, 36.94s, 36.56s

Calculate the period of the pendulum. [2]

(b) State and explain two factors which affect the period of the pendulum. [2]

1. ……

……

2. ……

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2 A motorcyclist drives along a straight road. Fig 2.1 below gives information about the first 10 s of his ride.

Fig 2.1

(a) Describe the motion of the cyclist during the first 10 s. [2]

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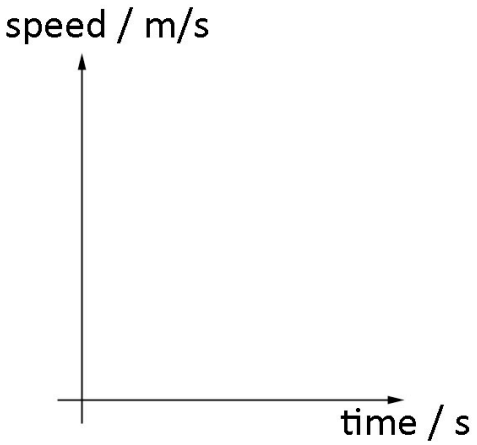
(b) Calculate the acceleration of the motorcyclist from 5 to 10 s. [2]

(c) **(i)** Sketch a speed-time graph of the motorcyclist on the axes provided. [1]
Include on the graph the information given from Fig 2.1.



(ii) Hence, calculate the distance travelled by the motorcyclist in the first 10 s. [2]

3 Fig 3.1 shows a free-fall parachutist falling vertically downwards. Fig 3.2 shows how the speed of the parachutist varies with time. The acceleration due to gravity is 10 m/s^2.

Fig 3.1

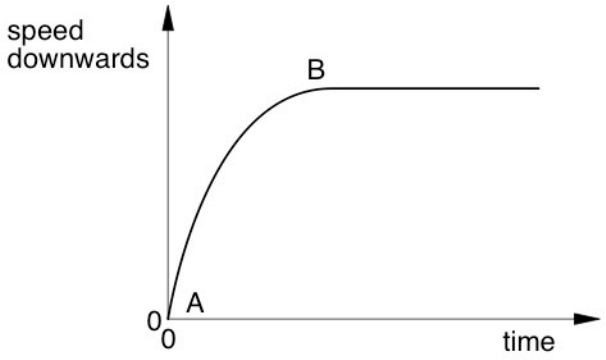


Fig 3.2

(a) State the name of the upward force acting on the parachutist. [1]

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(b) **(i)** State the initial acceleration of the parachutist. [1]

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(ii) Explain why the acceleration decreases from A to B. [2]

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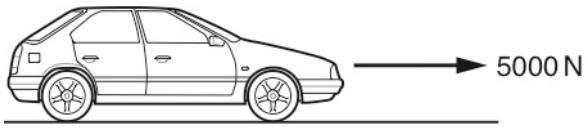
4 The engine of a car provides a driving force of 5000 N when the driver steps on the accelerator.



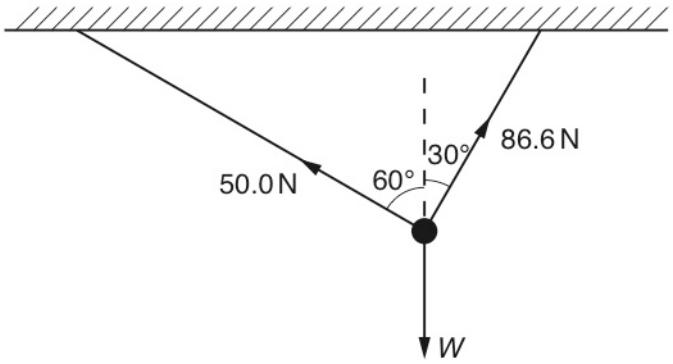
It is known that the car has a mass of 1000 kg.

(a) Calculate the acceleration of the car. [2]

In reality, the car only has an acceleration of 3.8 m/s^2.

(b) Calculate the frictional force acting on the car. [2]

5 An object of weight *W* is suspended by two ropes from a beam, as shown in the figure below.



The tension in the ropes are 50.0 N and 86.6 N, as shown.

In the space below, draw a scale diagram to find the resultant force due to the 2 tensions in the rope. State the scale used. [4]

Scale used: 1cm to represent _____

Resultant force: _____

6 Deah measures the mass and volume of four samples of rock **A**, **B**, **C** and **D**. The results obtained are shown in table 6.1 below.

	A	**B**	**C**	**D**
Mass / g	101	202	448	4508
Volume / cm^3	22	44	80	978

Table 6.1

(a) Calculate the density of rock **A**. [2]

(b) Three of the rocks are made of the same material.
State and explain which rock is made from a different material. [2]

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You are given a list of various substances, and their densities when in the liquid state in table 6.2 below.

Substance	**Density / gcm^{-3}**
Titanium	4.54
Selenium	4.8
Zinc	7.0

Table 6.2

Eunice suggests that in order to identify the rock sample from **(b)**, we can prepare a beaker filled with a liquid substance to observe if it floats or sinks.

(c) **(i)** Which substance, from table 6.2, will you choose to fill the beaker with? [1]

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(ii) Explain your answer, stating the expected observations. [1]

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7 A uniform metre rule is pivoted at its centre, which is also the position of its centre of mass.

Three loads, 2.0 N, *F*, and 3.0 N are positioned on the rule at the 20 cm, 30 cm and 90 cm marks respectively, as shown in the diagram below.

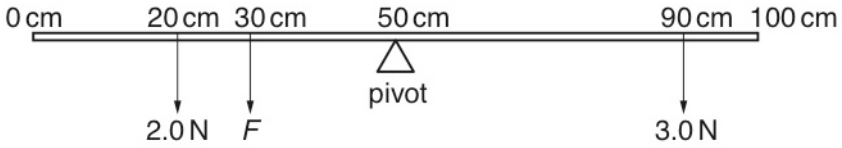

Fig 7.1

(a) State the *Principle of Moments*. [2]

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(b) Calculate the moment of the 3.0 N load about the pivot. [1]

(c) Given that the metre rule is in equilibrium under the forces as shown in Fig 7.1, calculate the value of *F*. [3]

8 Fig 8.1 below shows a model of a cable-car system. It is driven by an electric motor coupled to a gear system.

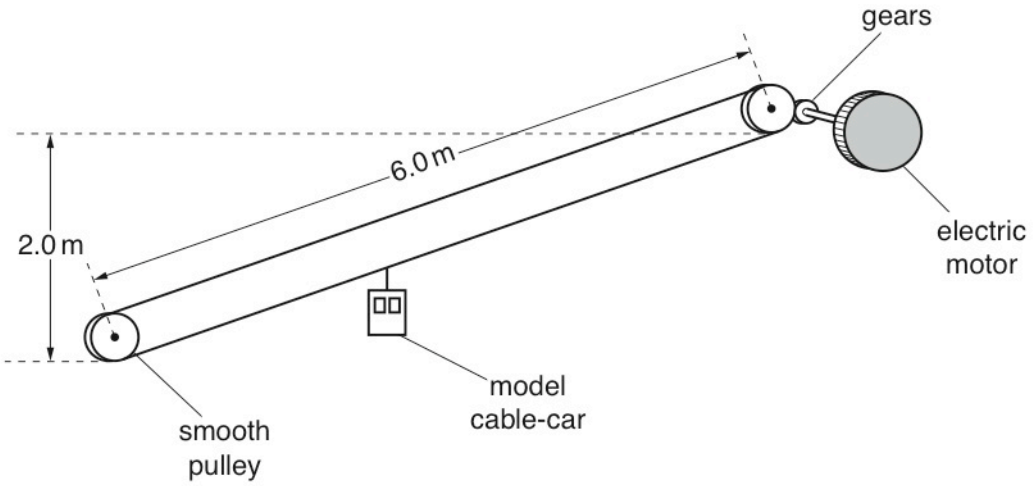

Fig 8.1

The model cable-car has a mass of 5.0 kg and is lifted from the bottom pulley to the top pulley in 40 s. It stops automatically when it reaches the top.

Calculate

(a) the average speed of the cable car, [2]

(b) the gravitational potential energy gained by the cable-car, [2]

(c) the useful output power of the electric motor. [2]

(d) Suggest if the actual output power of the electric motor is higher, lower or the same as the answer that you have calculated in **(c)**. Explain your answer. [2]

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9 A U-shaped tube, of constant cross-sectional area, contains some water of density 1000 kg/m^3. Oil that does not mix with water is then poured into the right-hand side of the tube. Fig 9.1 below shows the levels of the water and the oil when equilibrium is reached.

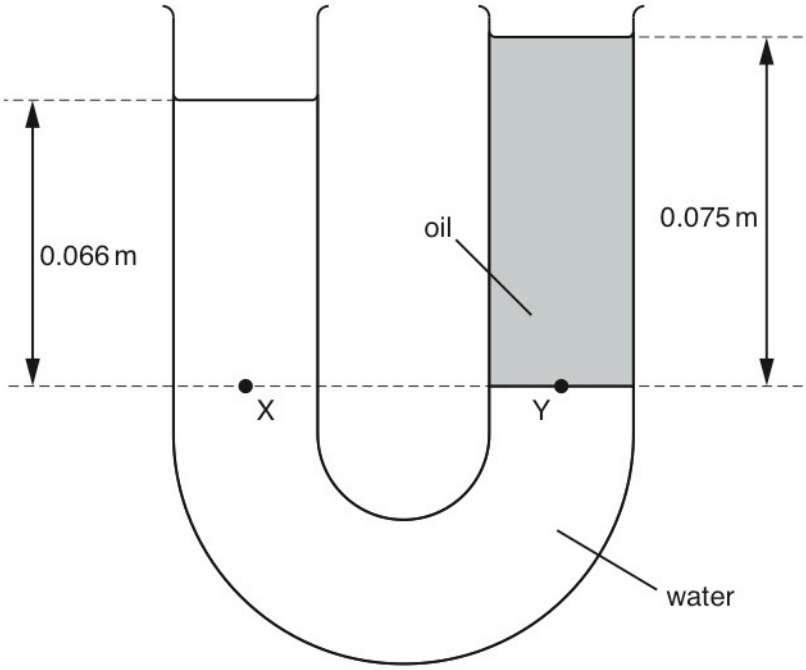

Fig 9.1

Points **X** and **Y** are at the same horizontal level. **X** is 0.066m below the top surface of the water and **Y** is 0.075m below the top surface of the oil.

(a) State two factors which affect the pressure beneath the surface of a liquid. [2]

1. .....

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2. .....

.....

(b) Calculate the pressure at **Y**. [3]

(c) Hence, calculate the density of the oil. [2]

Section B [30 MARKS]

Answer 3 questions in the spaces provided.
Question 12 has a choice of parts to answer. Choose either 12A or 12B to answer.

10 Many cars are fitted with an air-bag, as shown in Fig 10.1 below. In a collision, a compressed gas cylinder inflates the air-bag and reduces the effect of an impact between the passenger and the dashboard.

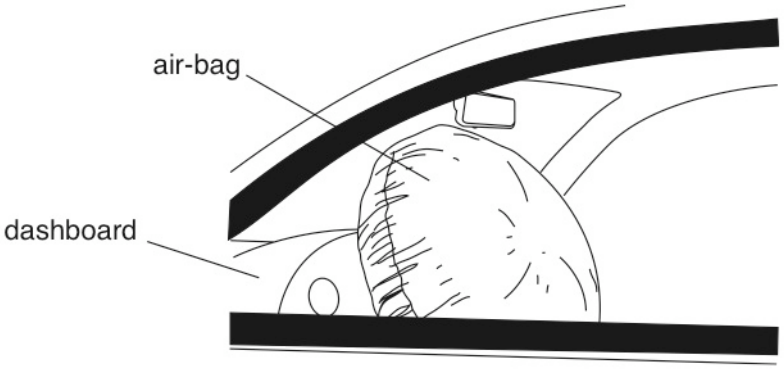

Fig 10.1

Air-bag manufacturers simulate collisions using a heavy ball to represent a passenger in the laboratory. Table 10.2 lists some information obtained during a test crash.

Description	Quantity
Initial speed of car	14 m/s
Time taken for car to come to rest	3.0 s
Mass of passenger (heavy ball)	5.0 kg
Volume of compressed gas cylinder	6.0×10^{-2} m^3
Pressure of compressed gas cylinder	1.4×10^{7} Pa
Volume of inflated air bag	30 000 cm^3
Crash area of inflated air bag	0.45 m^2

Table 10.2

(a) Calculate the average deceleration of the car. [2]

(b) Calculate the average force acting on the ball during this time. [2]

(c) The inflated air-bag reduces the pressure exerted on the ball. State two reasons why the pressure is reduced. [2]

1. ……

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2. ……

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(d) The surface area of the compressed gas cylinder is 0.023 m^2, calculate the average force acting on the walls of the compressed gas cylinder. [2]

(e) Experts criticise this method of testing, as the mass of the heavy ball is much less than the average mass of a passenger. Suggest what difference a real passenger with more mass will have during a crash. Explain your answer. [2]

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11 **(a)** State the *Principle of Conservation of Energy*. [2]

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(b) Fig 11.1 below shows how an electrically powered pump is used to raise water from tank **A** to tank **B.**

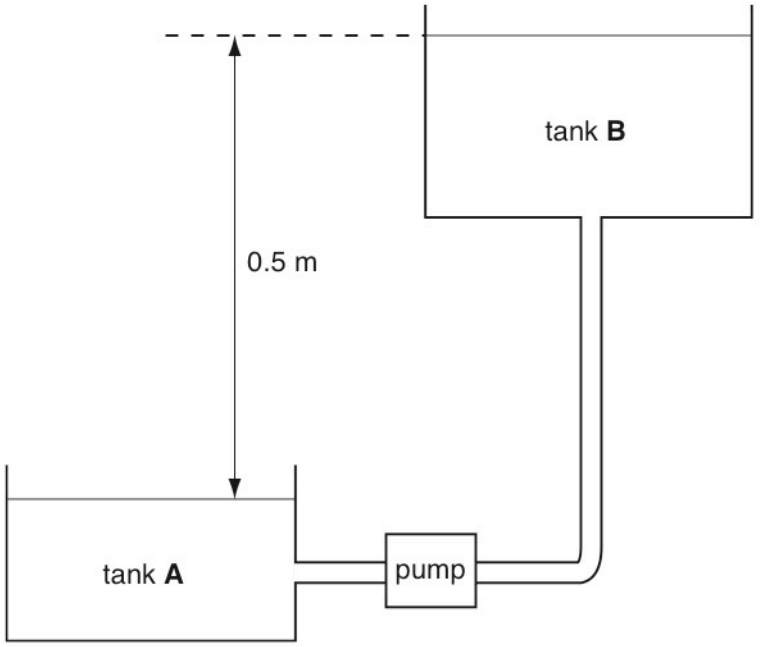

Fig 11.1

(i) Describe one energy conversion produced by the pump. [1]

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A mass of 0.1 kg of water is raised through a height of 0.5 m every second. Given that the gravitational field strength is 10 N/kg, calculate

(ii) the gravitational potential energy gained by this mass of water every second [2]

(iii) the useful output power of the pump. [2]

(iv) Suggest why the pump needs to work harder when the volume of water in tank **B** is increased. Explain your answer. [2]

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(v) Seawater is denser than pure water. Explain the difference, if any, in in the work done by the pump in moving the same volume of seawater from tank **A** to tank **B.** [1]

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EITHER

12A NASA plans to send astronauts to Mars to examine rocks on its surface. They will then produce a report containing information about conditions on Mars.

The gravitational field strengths on the surface of Mars and on Earth are 3.7 N/kg and 10 N/kg respectively.

(a) **(i)** Calculate the weight of a piece of rock, which has a mass of 0.50 kg on Mars. [2]

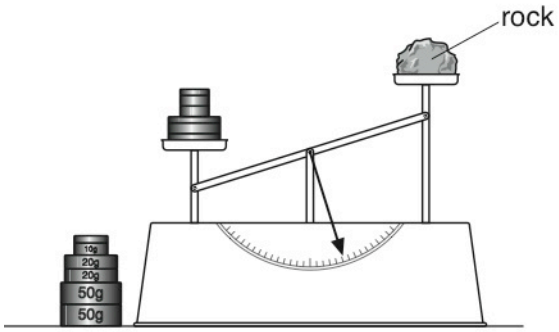
(ii) The rock is dropped and falls to the surface of Mars. State the acceleration of the falling rock. You may ignore the effects of air resistance. [1]

Acceleration of Falling Rock: .....

(iii) What is the weight of the rock, when it is brought back to Earth? [1]

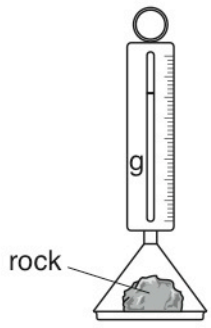
While still on the surface of Mars, the astronauts will measure the mass of each rock collected. The figure below shows two devices that are used for measuring masses on Earth.

device A



A lever arm balance and a set of brass discs. The mass of each disc is accurately determined on Earth and the value is marked on it.

device B



A spring balance. The spring balance is accurately calibrated on Earth and the mass values are marked on the vertical scale.

(b) When the two devices are used on Mars, which device will give the correct reading for mass? Explain why. [2]

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(c) Apart from measuring the mass of the rock, the astronauts are also required to determine the density of the rocks collected.

(i) State what other information is needed in order to calculate density. [1]

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(ii) Describe a method to determine the information that you have stated in **(c)(i)** for a small irregularly shaped rock. [3]

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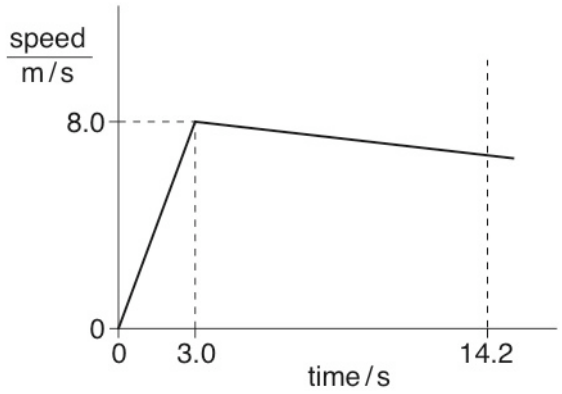
OR

12B A young athlete has a mass of 42 kg. On a day when there is no wind, she runs a 100 m race in 14.2 s. A speed-time graph of the race is shown below.



(a) Calculate

(i) the acceleration of the athlete in the first 3.0 s of the race, [2]

(ii) the accelerating force on the athlete during the first 3.0 s of the race, [2]

(iii) the distance traveled by the athlete during the first 3.0s of the race. [1]

(b) By considering the area under the graph or otherwise, calculate the speed with which she crosses the finishing line. [3]

(c) Suggest two differences that might be seen in the graph if there had been a strong wind opposing the runners in the race. [2]

1. ……

……

2. ……

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END OF PAPER